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AN OVERLOOKED *BUSYCON* WHELK (MELONGENIDAE) FROM THE EASTERN UNITED STATES

Bretton W. Kent

Department of Zoology
University of Maryland
College Park, MD 20742

ABSTRACT

Busycon laeostomum new species, a large living sinistral *Busycon* whelk is described from the eastern United States. This new species is compared with *B. carica* (Gmelin, 1791) and *B. contrarium* (Conrad, 1840) and its subgeneric affinities are discussed.

A large, sinistral *Busycon* is occasionally collected offshore along the Atlantic coast of the United States between southern New Jersey and northern Virginia. This whelk frequently has a pure white shell and has been referred to

as either a sinistral form of *B. carica* (Gmelin, 1791) or as *B. contrarium* (Conrad, 1840) (Abbott, 1974, p. 222). Here I show that this whelk is distinct from sympatric *B. carica* and *B. contrarium*, and describe this new species.



FIGS. 1-5. *Buccinum undatum* Linnaeus, sp. 1, 258 mm (Pope collection); 2, 213 mm (USNM no. 679720), 3, 222 mm (with soft tissues and operculum; H. S. G. collection), 4, 224 mm (USNM no. 806850), and 5, 221 mm (siphonal canal broken; USNM no. 806850).

Busycon laeostomum, new species

Figs. 1-5, 7, 10

Shell Description – Shell sinistral, solid, subpyriform, inflated; shoulder rounded, tuberculate; spire low, subconical; spiral cords on spire weak or absent; aperture broad, elliptical, longer than siphonal canal; anal ridge on parietal wall narrow, weak; siphonal canal open, somewhat flaring; columella broad, strongly bowed; spiral cords on body whorl restricted to dorsum of siphonal canal, weak; shell exterior usually chalky, white or pale pinkish-orange, occasionally with indistinct slightly darker suffusions; periostracum minutely ciliated; aperture white or light pinkish-orange; apertural lirae absent or rarely weak.

Description of Animal – Head and foot black; operculum corneous, elliptical, lingulate, nucleus apical; radula with 3 teeth per row, 5-6 cusps on central teeth.

Material Examined – **Holotype** – Length = 245 mm (U.S. National Museum no. 806849); trapped in 10-15 m of water off Stone Harbor, New Jersey, January 1979. **Paratypes** – Length = 184 mm (USNM no. 678850); dredged 8-10 km off Avalon, New Jersey, July 1967. Length = 213, 176 and 138 mm (USNM no. 679720); dredged off Ocean City, Maryland, 1969. Length = 224 and 221 mm (USNM no. 806850) and 222 and 220 mm (M. G. Harasewych collection); trapped off Stone Harbor, New Jersey in 10-15 m of water, January 1979. Length = 220 mm (USNM no. 806851); off Avalon, New Jersey, 1968. Length = 258 mm (Theresa R. Pope collection) and 83 mm (author's collection); collected as beach shells at Tom's Cove, Assateague Island, Virginia, April 1977. Length = 163 mm (Geerat J. Vermeij collection); off Ocean City, Maryland, 1977.

Type Locality – Stone Harbor, New Jersey; in 10-15 m of water.

Range – Southern New Jersey to northern Virginia; offshore.

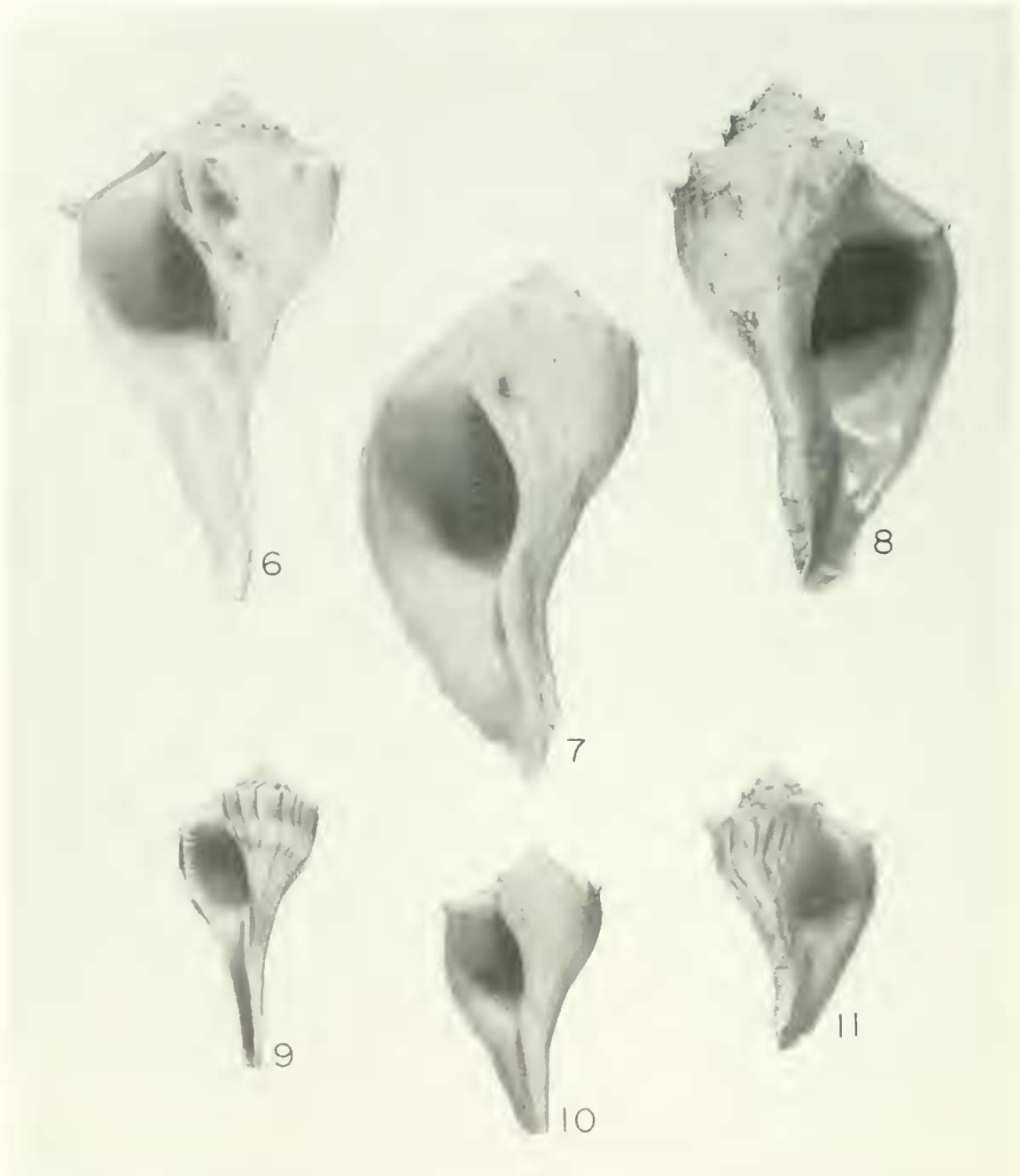
Etymology – *laios* (Gk.) = left, *stoma* (Gk.) = mouth.

Remarks – *B. laeostomum* is sinistral and has a ciliated periostracum like *B. contrarium*, but otherwise more closely resembles *B. carica* in

general shell shape (Figs. 6-11, Table 1). *B. contrarium* is more slender and has a more angular shoulder than *B. laeostomum*, although tubercles along the shoulder make the latter difference somewhat difficult to observe in photographs (e.g. – Figs. 4 and 10). *B. contrarium* and *B. laeostomum* also differ with respect to the development of these tubercles, the nature of the external spiral cords and apertural lirae, the shape of the columella, and the color of the shell. While *B. laeostomum* has only rounded tubercles along the shoulder, in *B. contrarium* these tubercles are frequently elongated into prominent spines. *B. contrarium* also has well-developed spiral cords and apertural lirae which become obsolete in later whorls. In *B. laeostomum* these cords and lirae are very weakly developed or more commonly completely absent, even in the early whorls (e.g. – compare Figs. 9 and 10). The columella of *B. contrarium* is slender and relatively straight compared to broad, strongly bowed columella of *B. laeostomum*. Finally, the dark brown axial streaks that usually occur on the early whorls of *B. contrarium* (Fig. 9) do not occur in *B. laeostomum*. In *B. laeostomum* 62% of the types (8 of 13) had a pure white shell; the remaining shells were a

TABLE 1. Comparison of northern *Busycon contrarium* and *B. carica* with *B. laeostomum*, with respect to spire angle, the ratio of siphonal canal length to aperture length, aperture shape (= aperture width divided by aperture length) and canal shape (= canal width halfway along canal divided by canal length). The values listed are means with ranges indicated in parentheses. Shells with badly broken lips or siphonal canals were not measured. Differences were tested for significance with a one-tailed Mann-Whitney U test and the level of significance is indicated by asterisks (i.e. * indicates $p < 0.05$, ** indicates $p < 0.01$, and *** indicates $p < 0.001$).

	<i>contrarium</i>	<i>laeostomum</i>	<i>carica</i>
Spire Angle	94°** (85-121°)	105° (92-126°)	81°*** (75-90°)
Canal: Aperture Ratio	1.10*** (0.87-1.48)	0.77 (0.66-0.93)	0.82 (0.72-0.93)
Aperture Shape	0.60 (0.57-0.64)	0.60 (0.57-0.64)	0.58 (0.51-0.63)
Canal Shape	0.19*** (0.14-0.26)	0.33 (0.24-0.41)	0.29 (0.19-0.35)
N	15	10	12
Size Range	75-224 mm	83-258 mm	93-219 mm



FIGS. 6-11. Comparison of typical adults (upper row) and juveniles (lower row) of *Busycon contrarium* (Fig. 6 and 9), *B. lucasorum* (Fig. 7 and 10) and *B. carica* (Fig. 8 and 11). 6, 224 mm, 7, 245 mm (holotype; USNM no. 806849), 8, 191 mm, 9, 88 mm, 10, 84 mm (author's collection), and 11, 93 mm.

pale pinkish-orange with slightly darker suffusions. Fully white shells (i.e.—no axial streaks even on the carac whorls) are known to occur in

B. contrarium, but are very rare (Hollister 1958). I have examined four white *B. contrarium* (USNM nos. 36298, 414722, 609947,

and 631770). Except for the white shells these *B. contrarium* are indistinguishable from other *B. contrarium*. This suggests that *B. laeostomum* is not merely a white-shelled morph of *B. contrarium*. Further, *B. laeostomum* is probably not just a northern form of *B. contrarium*. The two species are sympatric throughout the range of *B. laeostomum*, rather than having contiguous or disjunct ranges as would be expected of geographic morphs.

Although *B. laeostomum* and *B. carica* are similar in shape (Figs. 7, 8, 10 and 11, Table 1), several lines of evidence suggest that they are not merely sinistral and dextral morphs of the same species. *B. laeostomum* and *B. carica* differ, not only with respect to handedness and the nature of the periostracum, but also in spire angle (compare spires in figs. 7, 8, 10 and 11; Table 1), the shape of the anal ridge, and shell color. The anal ridge in *B. carica* is a swollen prominence (Hollister 1958) that is very different from the weak ridge in *B. laeostomum*. *B. carica* also frequently has a bright reddish-orange aperture (Hollister 1958), but this has not been observed in *B. laeostomum*. The white shells which commonly occur in *B. laeostomum* have not been reported in *B. carica*.

If *B. laeostomum* and *B. carica* were sinistral and dextral morphs of the same species they should have similar geographic and bathymetric ranges. The geographic ranges of the two species are very different; *B. carica* occurs from Massachusetts to northern Florida (Abbott 1974), while *B. laeostomum* has a restricted range between southern New Jersey and northern Virginia. The bathymetric ranges are also different. *B. carica* occurs both intertidally and subtidally in areas where it is sympatric with *B. laeostomum* (pers. observ., M. G. Harasewych, pers. comm.), while all of the live-collected *B. laeostomum* were subtidal.

Finally, differences in handedness may preclude copulation between *B. laeostomum* and *B. carica*. There is no direct evidence that sinistral and dextral morphs are unable to copulate, but as Pulley (1959) has argued, even slight difficulty in copulation would reduce gene flow between the two forms. If copulation between the

two morphs were possible, egg capsules should occasionally be found containing both sinistral and dextral individuals. Gill (1867) examined over 500 *B. carica* egg capsules, but found only dextral individuals.

The presence of sinistral coiling and a ciliated periostracum strongly suggests that *B. laeostomum* is much more closely allied to *B. contrarium* than to *B. carica*. Consequently, *B. laeostomum* should be placed in the subgenus *Sinistrofulgur* Hollister 1958 with *B. contrarium* and *B. perversum* Linné 1758.

B. laeostomum is also distinct from fossil sinistral *Busycon*, which have either prominent shoulder spines, such as *B. adversarium* Conrad 1862 and *B. obfilosum* (Grabau 1903), or strong external spiral cords, such as *B. obrapum* (Grabau 1903) and *B. perversum roborosense* Gardner 1948. In *B. laeostomum* the shoulder is tuberculate, but not spiny, and the spiral cords are absent or only very weakly developed even in small individuals. The absence of fossil forms similar to *B. laeostomum* suggests that this species is relatively recent, possibly a northern, Pleistocene offshoot of *B. contrarium*.

Conclusions – Hollister (1958) reviewed the extant species of *Busycon*, but made no mention of a form resembling *B. laeostomum*. This omission appears to be due to a lack of well-preserved specimens. Except for a few heavily beachworn specimens in the Academy of Natural Sciences in Philadelphia, which may be referable to *B. laeostomum*, no specimens of *B. laeostomum* appear to have been in museums prior to 1967. Beachworn *B. laeostomum* are difficult to separate from *B. contrarium* and *B. carica*, so in the absence of live-collected specimens confusion between the three species was not surprising. Only in the past few years as live-collected *B. laeostomum* became available for study has it been possible to differentiate these three species.

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NOTES ON THE MORPHOLOGY OF *CANCELLARIA RETICULATA*
 (GASTROPODA: CANCELLARIIDAE)

M. G. Harasewych

College of Marine Studies
 University of Delaware
 Newark, Delaware 19711

and

Richard E. Petit

P.O. Box 30
 North Myrtle Beach,
 South Carolina 29582

ABSTRACT

Cancellaria reticulata (Linné, 1767), the type species of the type genus of Cancellariaceae, inhabits subtidal sandy bottoms of the temperate and tropical western Atlantic. Externally, the cancellate shell is smooth and well adapted for burrowing. Internally, it has periodic reinforcing structures analogous to muricid varices. With the exception of an enlarged, bilobed left cephalic tentacle, external features, as well as those of the pallial complex and reproductive systems are not unlike those of other Neogastropods. The nervous system differs from the usual raehiglossan arrangement only in the extreme anterior placement of buccal ganglia and the resulting length of cerebro-buccal connectives. The cuticularized lining of the buccal cavity, highly specialized radula, lack of anterior oesophagus, anterior placement of buccal ganglia and simplified alimentary system posterior to the valve of Leiblein are features that distinguish this superfamily from other Neogastropods. Although the food and feeding mechanisms remain unknown, the functional morphology of the alimentary system suggests a diet of soft tissue or fluid. Scanning electron micrographs reveal the complex structure of the radular tip, which raises the possibility that the cancellariid radula was formed by fusion of central and lateral teeth, rather than by the loss of lateral teeth, as previously believed.

The cancellariaceans comprise a small, monophyletic and morphologically compact group of marine neogastropods that inhabit subtidal to bathyal sand and mud bottoms of tropical and temperate regions. The earliest known fossil record is from the Lower Cretaceous (Upper Albian) of Austria, while the greatest diversity in the Recent taxa occurs along the eastern

Pacific coast and in the central Indo-Pacific area. The relationship between numerous cancellariids from various Cretaceous deposits has not been investigated. Several genera based on Cretaceous species have been placed in Cancellariidae by some authors, and elsewhere by others.

The taxonomic position of this group has, until